An Analytical Study for Global Buckling of Circular Tubes under Axial and Oblique Compression

Wei Wang, XinMing Qiu

www.elsevier.com/locate/ijmecsci

PII: S0020-7403(17)30628-8
DOI: http://dx.doi.org/10.1016/j.ijmecsci.2017.03.019
Reference: MS3631

To appear in: *International Journal of Mechanical Sciences*

Received date: 30 August 2016
Revised date: 1 March 2017
Accepted date: 14 March 2017

Cite this article as: Wei Wang and XinMing Qiu, An Analytical Study for Global Buckling of Circular Tubes under Axial and Oblique Compression, *International Journal of Mechanical Sciences* http://dx.doi.org/10.1016/j.ijmecsci.2017.03.019

An Analytical Study for Global Buckling of Circular Tubes under Axial and Oblique Compression

Wei WANG, XinMing QIU*

Department of Engineering Mechanics, Tsinghua University, Beijing 100084, China

*Corresponding author, 8610-62772329, Email: qxm@tsinghua.edu.cn

Abstract

An analytical model is proposed for global buckling circular tubes of low diameter-to-thickness ratio ($25 < D/t < 40$) and moderate length ($7 < L/D < 8$), based on experimental observations and numerical simulations. Compared with FEM simulations, the current model gives accurate predictions on the whole load-displacement curve, energy dissipation and peak force.

Employing this model, the energy absorption properties of circular metal tubes are analyzed. For global buckling tubes of same geometry, fixed boundary can absorb more energy than free boundary due to the bending plastic mechanism at ends. For oblique compression (compression angle $\leq 30^{\circ}$), the load-displacement curve of global buckling is similar to that of uniaxial compression. For tubes of different geometries under uniaxial compression, the total response and energy absorption ability are compared between global buckling and progressive buckling. If the effective stoke is small, the specific energy absorbing (SEA) of global buckling tube could be higher than progressive buckling tube.

Keywords:

global buckling, circular tube, deformation mechanism, energy absorption, peak force, oblique